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Proposal for the implementation of pro-environmental behaviours in the form of open eco-innovations – A perspective of consumers of hotel services

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ABSTRACT

The role of eco-innovations in the contemporary hotel business is not only a marketing façade aiming at attracting the attention of a potential guest with a high environmental awareness, but more and more often it becomes a form of the operationalisation of environmental objectives inscribed in hotels' strategies. However, these objectives cannot exist only in the minds of hotel employees and managers, but should be communicated to all stakeholders, including hotel guests. Looking at the problem of environmental degradation more broadly, it is worth noting that the need to reverse the anti-ecological tendencies of world economies is becoming not so much a regional challenge as a global one. Thus, pro-ecological solutions implemented in individual hotels and even hotel chains cannot remain the exclusive domain of such establishments, but should be popularised, or at least easily accessible to other hotel chains, which, in this respect, function as co-competitors with the same goal in mind rather than competitors. The cognitive aim of this study is to identify the characteristic features of ecological awareness and to propose recommendations for pro-ecological behaviours in the form of open eco-innovations. The achievement of this objective required the execution of a research project involving 1351 hotel guests. The research was carried out using a questionnaire method in Poland's largest cities during the holiday months of 2021. The general willingness to incur additional financial burdens related to pro-ecological measures is declared by slightly more than one third of respondents. The vast majority of hotel guests choose to accept a variety of pro-ecological measures and restrictions.

1. Introduction

The dynamic development of transport, including the possibility of low-cost flights, and the expansion of accommodation and catering services have contributed to the intensive growth of tourism and the hotel industry. However, this phenomenon has also had a negative side in the form of environmental degradation, which has been reported by researchers and environmental organisations for several decades. Particularly in the last three decades, the hotel industry has been taking steps to introduce various solutions to offset the negative environmental impact. Quality management systems, pro-environmental management concepts are being implemented, "green" people management processes are being introduced, and pro-environmental behaviours of both employees and hotel guests are being shaped. There is no doubt that pro-environmental awareness plays an important role in this process. It influences both employees' behaviours and hotel guests'

decisions regarding the use of various services. However, the implementation of environmental programmes in hotels is difficult due to the fact that customers tend to perceive such programmes as hotels' efforts to reduce their own costs, at the expense of the quality of provided services (Baker et al., 2014; Hsin-Hui Hu, 2014).

To date, many studies have been conducted on the pro-environmental behaviours of hotel guests (cf. Han and Hyun, 2018; Heesup et al., 2019). While in the case of employees, environmental awareness and concern for the environment contribute to the strengthening of pro-environmental behaviours (Law et al., 2017; Tariq et al., 2020), this is no longer so obvious with regard to hotel guests. The reason for this is not so much the uncertainty as to who profits from pro-environmental activities, as the short duration of hotel stays and their character associated with leisure and even entertainment (Bugdol et al., 2019; Orynycz et al., 2021). Additionally, it should be remembered that in many cases people do not act in accordance with their environmental

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awareness or understanding of its importance because they do not appreciate the value of the environment (Ashley, 2000). It should also be remembered that views on the environment have changed over the last 20 years. In fact, research shows the importance of the environment in the context of the service sector. The impacts of services have been becoming a significant component of overall emissions, wastes, and energy consumption. The importance of the service sector in generating GDP in various countries is increasing, and at the same time, the financial sector (Streimikiene et al., 2023) and the education sector play a great role in the process of supporting environmental initiatives. The factor connecting people's behaviours and their environmental awareness is the knowledge of what impact humans have on the environment and the knowledge of how its negative impact can be reduced.

What is important from the point of view of hotel management practice is the extent to which environmental awareness and its specific features influence the decision-making process of the recipients of hotel services. In this, particular attention should be paid to their willingness to spend more for environmentally friendly hotel services. The knowledge of such factors will facilitate the shaping of environmental awareness, the selection of innovative ideas that can be put into practice and the sharing of successful solutions with other competitors.

A preliminary review of the literature on the subject shows that customers' willingness to pay extra has already been studied (García-Pozo et al., 2013; Lita et al., 2014; Rahman and Reynolds, 2019; Mach and Ponting, 2021). It has been found that hotel guests declare greater readiness to pay more for environmentally friendly hotels and, in practice, their behaviours may be influenced by the values promoted by such hotels (Rahman and Reynolds, 2019). It has also been found that knowledge plays an important role in the willingness to pay more for sustainable hotel services (Nelson et al., 2021). Some studies indicate that different socio-demographic categories such as gender, age and income play an important role in both environmental awareness and willingness to pay more (Ito and Kawazoe, 2018; Han et al., 2018a, 2018b; Tian et al., 2022; Gosh et al., 2022; Ladenburg and Skotte, 2022).

This raises the question of what set of socio-economic characteristics influences the environmental awareness of hotel guests as manifested in their assuming co-responsibility for the natural environment. It is also of interest to find out which practices may constitute an important group of eco-innovative solutions promoted in hotels. Addressing the research problem thus defined, we intend to bridge the existing gap in publications on this topic, at least to some extent. The recipients of this study may be hotel managers and all those interested in the practical implementation of various eco-innovations. Therefore, the cognitive objective of the study is to identify the characteristics of hotel guests' environmental awareness and their willingness to bear additional environmental burdens of a financial or non-financial nature. The pursuit of the cognitive objective will allow us to achieve the utilitarian goal of attempting to formulate recommendations for pro-environmental behaviours in the form of open eco-innovations.

2. Literature review

2.1. Environmental awareness

The term "environmental awareness" refers to how an individual perceives (evaluates) the impact of human activities on the environment (Kollmuss and Agyeman, 2002). This awareness is related to employees' knowledge, self-awareness and personal environmental views (Specq, 2016). The notion of environmental awareness appeared as early as the nineteenth century (Specq, 2016), but was not precisely defined at that time. Various studies refer not only to the commonly accepted term "environmental awareness", but also to ecological awareness or awareness of climate change, etc. Even customer awareness includes the concept of environmental awareness (how to buy products so as not to harm the environment).

2.2. Importance of environmental awareness and its determinants

Due to increasing consumer awareness of environmental issues, more and more hotels are developing various green practices (Moise et al., 2021). Increased environmental awareness is one of the factors for implementing environmental management systems (Tocan, 2016; Simpson and Sroufe, 2014). What matters in this context is personal standards and especially the awareness of the consequences of not taking appropriate actions (Papagiannakis and Lioukas, 2018). Awareness is regarded as one of the internal factors influencing the process of managing environmental aspects (Tocan, 2016). This awareness is ultimately important for decisions made by customers (Green consumerism, 2020), and some empirical studies have shown positive correlations between consumers' behaviours and environmentally friendly production practices (Hammami et al., 2018). Various research projects reported in the literature indicate that environmental awareness has a significant direct impact on employees' "green behaviour" (cf. Safari et al., 2018).

With regard to hotels, the level of environmental awareness and pro-ecological behaviours among guests has been shown to influence their cost-saving and pro-environmental activities (Gabarda-Mallorquí et al., 2018). Findings suggest that education, a household's income and the time of starting business activities are significantly related to environmental awareness (Ito and Kawazoe, 2018; Yucedag et al., 2018). However, specific measures (e.g., public awareness of household waste characteristics) are not necessarily related to gender or age (Han et al., 2018a, 2018b). Also, studies among employees have shown that there is no relationship between gender, age, income (employment), parental status and environmental awareness (Chedjou Jouontso, 2013). In addition, education, income and place of residence influence people's attitudes and perceptions of the urban environment (e.g., the perception of solid waste management in a city) (dos Santos et al., 2017).

2.3. Willingness to pay and its determinants

In terms of the willingness to pay more for services, research to date has looked at:

- paying more for environmentally friendly hotels (García-Pozo et al., 2013; Lita et al., 2014),
- purchasing green food (Cozzio et al., 2018),
- the importance of biospheric values (Rahman and Reynolds, 2019),
- paying more for sustainable surfing tourism products (cf. Mach and Ponting, 2021),
- hotel guests' environmental preferences (Nelson et al., 2021).

In these studies, consumers have been shown to be positive about the implementation of pro-environmental measures and therefore willing to pay a higher price for received services (García-Pozo et al., 2013; Lita et al., 2014).

What is important for behaviours is not only goals or social standards, but above all ethical and other values. Therefore, the willingness to pay more for hotel services may also depend on biospheric values (Rahman and Reynolds, 2019). Guests' environmental knowledge and preferences play an important role in their willingness to pay more for sustainable hotel services (Nelson et al., 2021). Research indicates that the tourist segment with high levels of "sustainable intelligence" is willing to pay more to visit a more sustainable tourism destination (Pulido-Fernández and López-Sánchez, 2016). Willingness to pay more is not just about sustainable intelligence. This tendency can be due to many other reasons. As studies already conducted have shown, the willingness to pay depends on a number of variables, including gender and income (Tian et al., 2022; Gosh et al., 2022; Ladenburg and Skotte, 2022), consumption pattern, product appearance, willingness to buy (Gosh et al., 2022), frequency of use (Ladenburg and Skotte, 2022), motivations and benefits received (Tian et al., 2022). In the case of

hotels, the willingness to pay also depends on a number of other variables, for example, the number of online reviews and the hotel category (Belarmino et al., 2021), or the location of individual rooms (Wong and Kim, 2012).

3. Eco-innovations in the hotel industry

Eco-innovations constitute another important issue in the undertaken research project. The concept of eco-innovation was first proposed by Fussler and James (1996), with the aim of reducing negative environmental impacts and gaining tangible business value for enterprises (Fussler and James, 1996). It is often equated with the concept of technological innovation. However, technology is only one aspect of the concept of eco-innovation (Ilic et al., 2022). Eco-innovations comprise all forms of technological and non-technological innovation. These are solutions that create both business opportunities and environmental benefits by preventing or reducing an organisation's negative impact on the environment (Istrițeanu et al., 2022). Eco-innovativeness is treated in various studies as a variable in a set of environmental management indexes (García-Pozo et al., 2015). The interest in eco-innovations makes hotels adjust their understanding of the essence of their business activities – what counts is environmental effects such as reduced consumption of resources, profits generated by the green image or lower environmental fees. Eco-innovations are categorised as tools to gain competitive advantage (de Oliveira Menezes and da Cunha, 2016), which – as some studies have shown – may be achieved independently of signals sent by environmentally conscious customers and outside of government regulatory actions (Magadán Díaz and Rivas García, 2018). In particular, global hotel chains are interested in eco-innovations due to their significant economic potential (de Oliveira Menezes and da Cunha, 2016). The development of green services, such as pro-innovation activities in hotels, depends on the green entrepreneurial orientation of customer involvement and the green creativity of employees. More recent research has revealed the positive nexus between organizational green entrepreneurial orientation and green service innovation perceptions (Luu, 2022). Eco-innovations in hotels are primarily influenced by external factors (e.g., the system of incentives), while technological factors are important for pro-ecological behavior. The role of knowledge is highlighted, in the reconfiguration of the set of implementation capabilities that triggers eco-innovation (Dias et al., 2021). Research also focuses on the perception of green practices by various stakeholders. It is so important that different stakeholders (managers, employees, customers) may evaluate the implementation of eco innovations in different ways (Khalil et al., 2022). When it comes to eco-innovations in hotels, it is impossible to ignore the role of guests, who have a huge impact on hotel energy consumption, operating costs and environmental issues. Promoting energy-efficient guest behavior is a promising strategy for the sustainability of the hotel industry. More recent research shows the important role of personality profiles and household habits in shaping the energy behavior of hotel guests (Wang et al., 2023a, 2023b). Various altruistic and moral values play an important role. Biospheric values have a stronger influence on the attitudes and personal norms of business guests. Attachment to the place has a stronger impact on long-term residents, and its contribution to the energy-saving behavior of business guests is smaller than that of other guests. In addition, leisure guests are more sensitive to moral obligations (Wang et al., 2023a, 2023b).

3.1. Reasons for the interest in eco-innovations and benefits of eco-innovations

The factors contributing to the growing interest in the concept of eco-innovation include changes in tourists' behaviours (García-Pozo et al., 2016; Kuo et al., 2022), the need to implement various solutions within a circular economy (Naydenov, 2018), the awareness of the links

between economic growth and environmental degradation (Chau et al., 2022) and increasingly stringent environmental regulations (Kuo et al., 2022).

The concept is becoming increasingly important as a way to introduce new or modified tourism products. The primary reason is that tourists take environmental issues into consideration when making purchasing decisions.

A relatively large number of studies point to the benefits derived by hotels from eco-innovations (García-Pozo et al., 2015; García-Pozo et al., 2016; Buijtendijk et al., 2018; Aboelmaged, 2018; Reyes-Santiago et al., 2019; Tariq et al., 2021; Xiong et al., 2022; Kuo et al., 2022).

The implementation of additional eco-innovative practices increases labour productivity by an average of 8.15% (García-Pozo et al., 2015). Research conducted in Spain has shown that the introduction of eco-innovative measures had a positive and significant impact on labour productivity, even though the economic crisis reduced productivity growth (García-Pozo et al., 2016).

A quantitative study of managers and professionals employed by hotels in the United Arab Emirates has shown the dynamic influence of pro-environmental attitudes and eco-innovative practices on hotels' performance (Aboelmaged, 2018).

The results of a survey of Mexican hotels have indicated that eco-innovations contribute to positive environmental outcomes (Reyes-Santiago et al., 2019). Similar results have been obtained in a study conducted in hotels in Pakistan (Tariq et al., 2021).

Through eco-innovations implemented in tourism businesses, environmental regulations imposed on the tourism sector and the shaping of behaviours based on "ecological consumption", benefits can be obtained in the form of reduced consumption of resources such as food, energy and water (Xiong et al., 2022).

Yet another study conducted in Taiwan has found that proactive environmental strategies implemented by hotels positively influence eco-innovations, which, in turn, directly influences green core competencies. Furthermore, these competencies facilitate the achievement of green competitive advantage. However, the aforementioned publications show that the impact of eco-innovations on green competitive advantage is not significant (Kuo et al., 2022).

3.2. Barriers to and constraints on eco-innovations

There are fewer studies focusing on barriers and constraints connected with the development of eco-innovations (Legrand et al., 2012; Vidickienė et al., 2021). W. Legrand (2012) points to the lack of financial resources (Legrand et al., 2012; Pineda and Brebbia, 2012), while de Oliveira Menezes, V. and da Cunha, S.K. (2016) mention difficulty in showing return on investment for investors, insufficient funds, lack of interest in eco-innovations, lack of control over all decisions (in a franchise system) and pressure from hotel guests (de Oliveira Menezes and da Cunha, 2016).

The barrier is not only hotels' limited funds for investment projects, but also the lack of adequate regulations and policies to foster "an environment for promoting transformational ecotourism as a successful innovation for the tourism sector of the future" (Vidickienė et al., 2021). The relevance of the legal regulations of tourism has also been highlighted in the results of research projects conducted in China (Xiong et al., 2022; Chau et al., 2022).

4. Research methods

A total of 1351 guests of six large three-star hotels located in four provincial cities in Poland – Warsaw, Cracow, Wrocław and Opole – took part in the research conducted to meet the established objectives (Fig 1). The research was carried out using a questionnaire method during the holiday months in 2021. The study used the diagnostic survey method, and the survey technique was used to collect data. The study covered three groups of respondents, i.e. hotel guests (partial



Fig. 1. A map showing the location of the research sites.
Source: the authors' own work.

study), employees and managers of the surveyed hotels (comprehensive study) and suppliers (comprehensive study).

Therefore, the research questionnaires had three versions dedicated to particular stakeholder groups. The questionnaire addressed to hotel guests was prepared on the basis of the conclusions from the literature analysis and included: 15 questions on research issues and 12 questions on specifics. The questionnaire for employees and managers had 21 questions on research issues and 15 metric questions, and the version intended for suppliers included the research problem in 17 questions on the researched issues and 8 metric questions. Disjunctive and conjunctive cafeteria were used in the surveys. The questions were usually closed-ended, sometimes half-open. Prior to the commencement of the main research, pilot studies were carried out. The issues discussed in this paper concern only hotel guests. Other groups will be discussed in other works by the authors.

The questionnaires were made available to hotel guests upon their first contact with the hotel reception. Hotel guests could return completed questionnaires to hotel staff at any time during their stay. A preliminary analysis of the collected material required a selection of the received questionnaires, which consequently reduced the number of respondents to 1317. Incorrectly completed questionnaires were rejected at the stage of creating the database and were not included in the further stages of the analysis. The size of the research sample allows for the verification of the research hypotheses, taking into account a significance level of 0.95 and an acceptable sampling error of $\pm 2.7\%$.

The research was performed by means of a survey instrument developed on the basis of the conducted literature review (Creswell, 2013; Easterby-Smith et al., 2015). It comprised two main parts and additional questions concerning socio-demographic data of respondents. The first part of the

questionnaire included questions about hotels' characteristic features and the respondent's related preferences. In the second part, the respondent was asked to answer 15 questions about pro-environmental behaviours. The questionnaire also underwent a reliability test based on Cronbach's alpha coefficient. The test result was 0.77.

A number of statistical analysis methods were used to review the data, ranging from a descriptive analysis of the structure of the answers given by respondents, through a regression analysis using standardised model parameters, to multivariate methods in the form of a correspondence analysis of qualitative characteristics.

The design of the survey instrument included the possibility to answer most questions and take into account the Likert scale. This data collection methodology allowed for the ranking of received answers, and consequently Spearman's rank correlation coefficient and correspondence analysis could be used.

The research model provided for investigating the environmental awareness of hotel guests and their willingness to incur additional costs related to their hotels' environmental activities, and then verifying a list of consumer eco-innovations in hotels, which was then a recommendation in the form of open eco-innovations.

Based on the literature review, the authors formulated the research problem presented in the introduction above and based on the research model shown below (Fig 2). The authors intended to determine what set of socio-economic characteristics influences the environmental awareness of hotel guests as manifested in their assuming co-responsibility for the natural environment. It is also worth finding an answer to the question of what practices may constitute a significant group of eco-innovative solutions promoted in hotels. In this context, two research hypotheses were formulated:

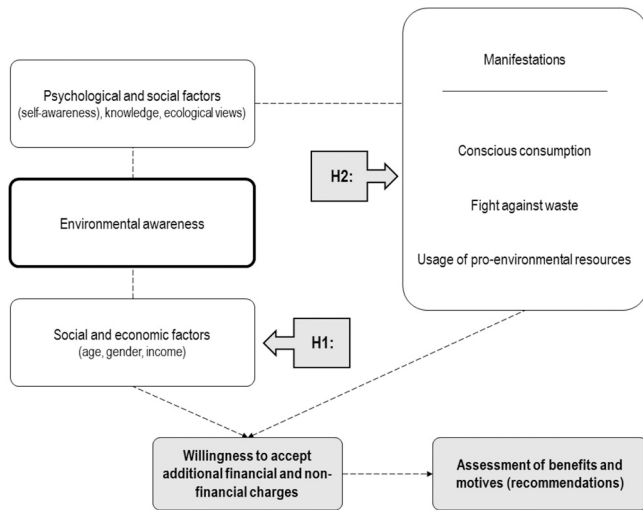


Fig. 2. Research model. Source: the authors' own work.

H1. Hotel guests' adopting pro-ecological behaviours is significantly related to their socio-economic characteristics, such as (H1a) age, (H1b) gender and (H1c) income.

H2. During their stay, hotel guests share with their hotels the responsibility for environmentally friendly activities.

Based on the literature review, the authors assume that factors such as knowledge, self-awareness, and ecological views are important for environmental awareness (Yadav and Pathak, 2014). Different socio-demographic categories such as gender, age and income play an important role in environmental awareness as well as willingness to pay more (cf. Han et al., 2018a, 2018b). This awareness in the case of hotel guests can be manifested in various behaviours, such as saving resources (Gabarda-Mallorquí et al., 2018). One manifestation of

environmental awareness can be the purchase of products and services that are pro-environmentally oriented (Fig 2).

5. Results

As mentioned in the introduction, the research sample consisted of 1317 guests of six Polish hotels. Among them, there were 482 men (36.6%) and 835 women (63.4%). Fig 3 presents the remaining data concerning the respondents. The age structure of the respondents indicates the predominance of young and middle-aged people, as slightly more often than one in three (35.5%) was under 25 years old. Almost every fourth respondent (23.2%) was aged 26–35. The same number of respondents were aged 36–45 (25.1%), and 12.7% were aged 46–55. People over 56 accounted for only 3.4%. The obtained age structure may indicate bias in the results in terms of age.

5.1. Willingness to incur additional expenses

The general willingness to incur additional financial burdens related to pro-ecological measures is declared by slightly more than one third of the respondents (36.8%). However, the structure of the size of the accepted burden is also an important issue. It has a right-sided asymmetric distribution, which means that among those accepting additional costs, hotel guests accepting lower financial burdens (from 4% to 10%) prevail and the mode of burdens is in the range of 4–5%. Fig 4 shows the structure of the respondents in the successive categories of accepted additional costs. These are also described using a second-order exponential function ($p < 0.05$).

Fig 5 illustrates the relationship between the willingness to pay extra for pro-environmental services (Af) and opinions on their impact on the quality of the services provided (ISQ) and on the price (IP), as well as the assessment of the level of environmental awareness (EA). It is worth noting that the guests willing to make the greatest sacrifices are located at a significant distance from the other points of the correspondence analysis graph. Those with the average willingness to incur additional charges are in the middle part, and those who do not accept additional costs are at the end of the broken line. At the same

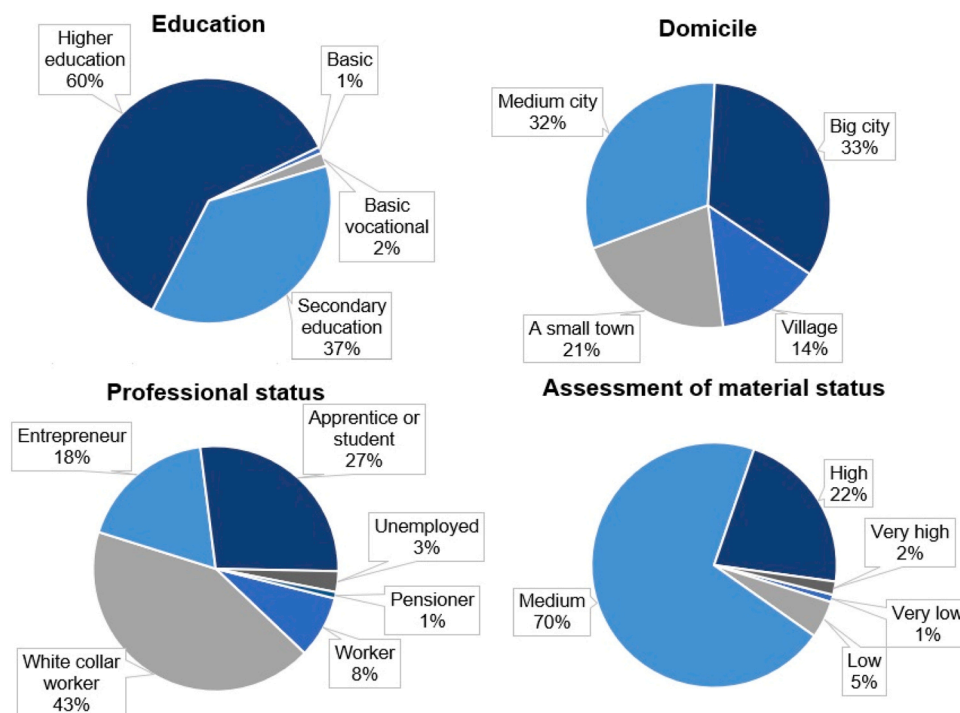


Fig. 3. Structure of respondents. Source: the authors' own work.

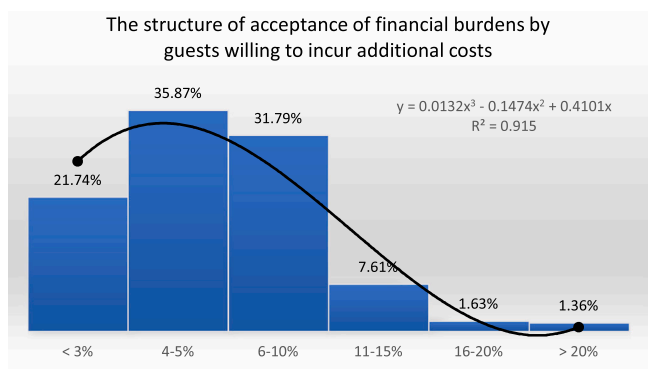


Fig. 4. The structure of acceptance of financial burdens related to pro-environmental activities and the second-order exponential function explaining the variation in acceptance of burdens. Source: the authors' own work.

time, it should be noted that there is a close correspondence between the unwillingness to incur additional charges and a low and very low rating of the environmental awareness of hotel guests. There is also a close correspondence between refusal to incur extra costs and a low and very low impact on service quality and even a low impact on price. For the average willingness to pay more (Af), i.e. willingness at the levels of up to 3%, 4–5%, 6–10% and 11–15%, relationships with high and very high environmental awareness (EA), as well as with strong and very strong influence on service quality (ISQ: 1 and 2) and on price (IP: 1 and 2) are discernible.

The willingness to accept additional fees remains in a relationship with other characteristics, making it possible to develop a linear regression equation to explain this observation. A statistically significant regression model ($p < 0.001$) was developed based on the characteristics such as gender, reason for staying in a hotel, education, having children and economic status. Thanks to the standardised values, it can be concluded that the relationship between the willingness to incur additional expenses and the characteristics such as gender, education and economic status is positive, which means that if the respondent was female, they were more likely to accept higher costs of hotel services

(0.196). Similarly, in the case of education: the more educated the respondent, the higher their willingness to participate in the costs of pro-ecological measures (0.091). The highest value of the beta coefficient is observed in the case of economic status: the higher it was, the easier it was for the respondent to agree to additional charges (0.251). On the other hand, in the case of the reason for staying in a hotel and having children, the relationship is negative, meaning that the higher willingness to incur extra costs was observed for those who stayed in a hotel for work purposes (-0.070) and those who did not have children (-0.102). Although not high, these values of the selected parameters are statistically significant, as only in one case the significance was 0.011 (reason for staying) and in all the others it was less than or equal to 0.001. (Table 1).

5.2. Environmental awareness

The respondents were also asked how often they exhibit certain pro-environmental behaviours during their hotel stay (A). Table 2 shows the percentage of the respondents who adopt such behaviours. It is worth noting that the leading behaviours in this respect are the habit of switching off unnecessary lighting (92.6%), as well as putting food on a plate (92.9%) and pouring beverages (92.7%) in the amount that can be consumed without waste. Behaviours related to personal hygiene and cleanliness are similarly popular, for example taking a shower rather than a bath (88.8%), keeping visited places clean (89.1%).

An analysis of the indicated pro-ecological behaviours in the context of their connections with the respondents' characteristics discloses several significant correlations ($p < 0.05$). They are presented in Table 3, in which each of the listed behaviours is correlated with each characteristic allowing for ranking. In this way, the values of Spearman's rank correlation coefficient were obtained for the individual behaviours and characteristics. The presented results indicate that the strongest characteristics discriminating (dividing) the respondents into significantly separate groups of behaviours are environmental awareness and gender. It is in the case of these characteristics that the highest (generally positive) correlations are observed. This means, therefore, that the respondents' declared self-assessments of their environmental awareness are consistent with their declarations of pro-environmental behaviours. Of course, this does not determine their actual approach to the issue, as the conclusion is based on declarations only. It is worth

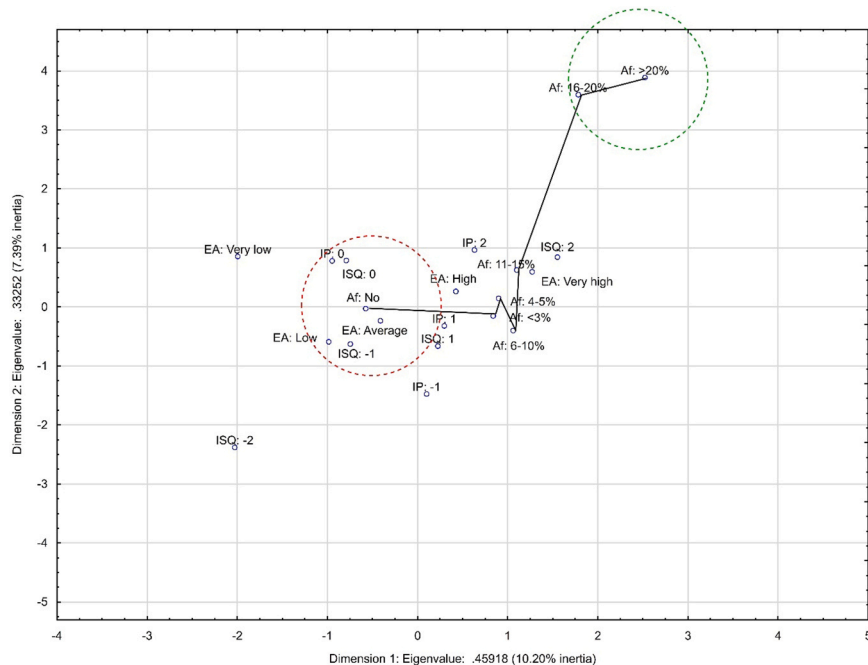


Fig. 5. The results of a correspondence analysis for the characteristics associated with the willingness to incur additional costs related to pro-ecological activities of hotels. Explanations: EA - level of ecological awareness, Af - willingness to accept additional fees, ISQ - assessment of the impact on service quality, IP - assessment of the impact on price. Source: the authors' own work

Table 1

Multivariate regression model and standardised parameters of the model explaining propensity for pro-environmental behaviours.
Source: the authors' own work

N = 1.317	<i>b</i> *	Standard error of <i>b</i> *	<i>b</i>	Standard error of <i>b</i>	<i>t</i>	<i>p</i>
Constant term			1.983	0.151	13.130	0.000
Sex	0.196	0.028	0.299	0.042	7.079	0.000
Theme of stay	-0.070	0.028	-0.110	0.043	-2.539	0.011
Education	0.091	0.026	0.110	0.032	3.480	0.001
Children	-0.102	0.027	-0.158	0.042	-3.733	0.000
Economic status	0.251	0.026	0.324	0.034	9.523	0.000

Table 2

The structure of occurrence of pro-environmental behaviours.
Source: the authors' own work

How often do you adopt the following pro-environmental behaviours in your hotel? (A)	%
A1 I take environmental issues into account when choosing my hotel	20.90%
A2 I use public transport when travelling to/from my hotel	53.70%
A3 I save water	84.10%
A4 I switch off lights when I don't need them	92.60%
A5 I switch off heating or air conditioning when I open a window	83.50%
A6 I segregate waste	84.30%
A7 I give up using a car during my stay	67.70%
A8 I minimise the use of plastic	75.70%
A9 I ask for towels and bedding to be changed when they are really dirty	84.20%
A10 I only put as much food on my plate as I can eat	92.90%
A11 I limit my consumption of meat products	42.10%
A12 I pour myself only as much beverage as I can drink	92.70%
A13 I prefer electronic rather than paper versions of documents	83.20%
A14 I prefer a shower to a bathtub	88.80%
A15 I buy from local suppliers	63.20%
A16 I take care of the cleanliness of the places I visit	89.10%
A17 I influence the pro-environmental behaviours of others	41.00%

noting that the convergence of declarations concerning individual behaviours is relatively high for almost all the listed behaviours. Particularly high convergence with the declared environmental awareness is shown by such behaviours as taking care of cleanliness in visited places ($r = 0.356, p < 0.01$) and influencing the pro-environmental behaviours of others ($r = 0.355, p < 0.01$). High results can also be observed in the case of taking environmental issues into account when choosing a hotel ($r = 0.284, p < 0.001$) or putting as much food on the plate as one can eat ($r = 0.271, p < 0.001$). The lowest correlation is observed for not using a car during a hotel stay ($r = 0.046, p = 0.097$). It is also interesting to note that all observed correlations are positive in this case, which means that no opinions were found that undermine the declared environmental awareness. Thus, it seems to be important evidence of the reliability of the received answers, as well as of the correct construction of the list of pro-environmental behaviours, since the overwhelming majority of the respondents describing their environmental awareness as high simultaneously chose the proposed behaviours.

The second discriminating characteristic is the gender of the respondents, where also mainly positive correlations were observed. For the sake of clarity in interpreting the obtained results, it should be explained that a correlation results close to zero means that there is no difference between the frequencies of adopting particular behaviours by men and women. A higher value of the correlation coefficient therefore means that there is a discrepancy in the frequency structure of the adopted behaviours, and not necessarily in the adoption of the

Table 3

A correlation table of the respondents' characteristics and the pro-environmental behaviours adopted by them.
Source: the authors' own work Explanations: LEA – level of ecological awareness.

Opinion	Gender	Age	Motive	Location	Education	Marital status	Children	Material condition	LEA
A1	0.119	0.008	-0.001	-0.020	-0.038	-0.069	-0.028	0.126	0.284
A2	0.056	0.007	-0.027	0.015	-0.044	-0.070	0.006	-0.081	0.097
A3	0.034	0.085	-0.097	-0.019	0.026	0.075	0.061	-0.014	0.196
A4	0.229	-0.166	0.109	0.107	0.048	-0.079	-0.121	-0.061	0.267
A5	0.095	0.036	-0.030	0.069	0.053	0.054	0.044	0.044	0.205
A6	0.086	0.038	-0.047	-0.067	0.049	0.047	0.041	-0.044	0.189
A7	0.007	0.150	-0.105	-0.038	-0.026	0.035	0.076	-0.037	0.046
A8	-0.085	0.264	-0.190	-0.052	0.024	0.172	0.191	0.004	0.156
A9	0.051	0.077	-0.066	0.012	-0.015	0.067	0.052	-0.007	0.158
A10	0.202	-0.111	0.070	0.080	0.065	-0.022	-0.073	-0.019	0.271
A11	0.139	0.064	-0.013	-0.011	0.014	-0.027	0.003	0.116	0.241
A12	0.219	-0.143	0.099	0.082	0.053	-0.041	-0.094	-0.029	0.256
A13	0.089	-0.018	0.009	0.076	0.073	0.009	-0.006	0.033	0.213
A14	0.048	0.032	-0.010	0.027	0.075	0.029	-0.005	0.014	0.147
A15	0.101	0.103	-0.014	-0.057	-0.004	0.049	0.056	0.094	0.213
A16	0.337	-0.256	0.202	0.068	0.049	-0.126	-0.190	-0.019	0.336
A17	0.202	-0.042	0.012	-0.019	0.015	-0.051	-0.024	0.063	0.355

opposite behaviours. In this case, the strength of the observed correlation is a measure of convergence in terms of the increasing or decreasing frequency of the behaviours adopted by women and men. Thus, where the correlation is close to zero, the responses provided by women and men are almost identical. An example is the willingness to refrain from using a car during a hotel stay ($r = 0.007, p = 0.796$).

Relatively higher correlation coefficient values were observed for keeping visited places clean ($r = 0.337, p < 0.001$) and switching off unnecessary lights ($r = 0.229, p < 0.001$). Thus, large differences are observed between men and women for these characteristics, but not in terms of divergent behaviours between men and women, but in terms of the frequency with which they are adopted. In the case of maintaining cleanliness in visited places, women are more determined in this respect than men, as 59.9% of them indicated that they always took this measure and 34.1% that they took it often, while among men the response structure was the opposite, with 26.8% of them taking this measure always and 53.7% – often. Similarly, with regard to switching off unnecessary lighting, 59.5% of women and 33% of men always remember about it. Such behaviour is adopted “often” by 33.1% of women and 59.5% of men.

There are also some other noteworthy exceptionally significant correlations between the selected characteristics and pro-environmental behaviours:

- There is a significant correlation between the age of the respondents and turning off the lights in rooms that were not used ($r = -0.166, p < 0.001$); it is simultaneously negative, which means that younger people declare this behaviour more often. The age of the respondents is also related to maintaining cleanliness in visited places ($r = -0.256, p < 0.001$). Also in this case, the younger generation shows a greater propensity for this behaviour.
- Restrictions on the use of plastic are the domain of guests staying in hotels for professional purposes. Guests staying at hotels during their leisure time are less likely to be willing to follow such restrictions ($r = -0.19, p < 0.001$).
- The level of education had no significant effect on the frequency of adopting environmentally friendly behaviours, as evidenced by the relatively low correlation coefficient values in this group of

comparisons. A similarly insignificant effect was noted for the factors of economic status and place of residence.

- Some significant correlations are noted for having children and the associated marital status of hotel guests. The same phenomena can be observed for both comparisons. Hotel guests who have children and/or spouses/partners have similar attitudes towards reducing the consumption of plastic ($r = 0.191, p < 0.001; r = 0.172, p < 0.001$) keeping their surroundings clean ($r = -0.19, p < 0.001; r = -0.126, p < 0.001$) and turning off unnecessary lighting ($r = -0.121, p < 0.001; r = -0.079, p < 0.001$).

It should be emphasised, however, that the identified correlations between characteristics and behaviours do not necessarily imply a cause-and-effect relationship. Probably the common reason for the similar structure of the respondents’ answers is the adopted pro-ecological attitude, which influences both their self-assessment with regard to environmental awareness and declared or practised behaviours.

Fig. 6 shows the correspondence between environmental awareness (EA) and the respondents’ characteristics such as (Q1) gender, (Q2) age, (Q3) reason for staying at a hotel, (Q4) place of residence, (Q5) education, (Q7) marital status, (Q8) having children, (Q9) economic status.

It is worth noting that the graph clearly separates high and very high environmental awareness (the lower part of the graph) from low and very low awareness (the upper part of the graph). High and very high environmental awareness is accompanied by higher education (Q5: 4), high and very high economic status (Q9: 4 and 5) and living in a large city (Q4: 4), while low and very low awareness is accompanied by characteristics such as low education (Q5: 1, 2 and 3), low economic status (Q9: 2) and living in towns or middle-sized cities (Q4: 2 and 3). The other differences are on the borderline between the two extremes (the correspondence distance is similar).

Examining the circumstances under which the aforementioned pro-environmental behaviours occurred (B), it was noted that the vast majority of the respondents adopted them as part of their daily household duties (91.3%), work performed at home on a remote basis (85.4%), or work performed on-site (83.8%). Such behaviours are the least frequent during weekend trips or holidays abroad (64.2%) (Table 4).

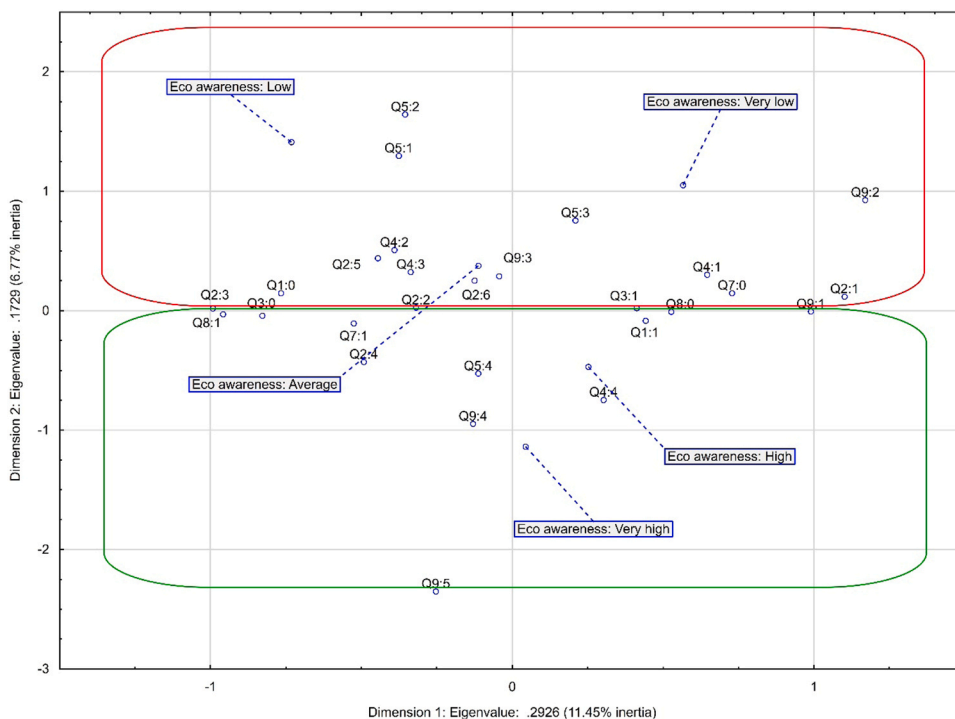


Fig. 6. The results of a correspondence analysis for the characteristics associated with hotel guests’ ecological awareness.

Source: the authors’ own work. Explanations: Q1 - gender (0 - male, 1 - female), Q2 - age (1-18-25, 2-26-35, 3-36-45, 4-46-55, 5-56-65, 6 - > 65), Q3 - reason for staying at hotel (0 - business, 1 - leisure), Q4 - place of residence (1 - village, 2 - small town, 3 - medium-sized city, 4 - large city), Q5 - education (1 - primary education, 2 - vocational education, 3 - secondary education, 4 - higher education), Q7 - marital status (0 - single, 1 - in a relationship), Q8 - children (0 - no, 1 - yes), Q9 - economic status (Q9: 1 - very low, 2 - low, 3 - average, 4 - high, 5 - very high).

Table 4

The structure of the respondents' answers regarding the circumstances of adopting pro-environmental behaviours.

Source: the authors' own work

How often do you demonstrate pro-environmental behaviours in the following circumstances?		%
B1	Professional work performed at the workplace	83.80%
B2	Professional work performed at home	85.40%
B3	Professional work performed on business trips	76.50%
B4	Dealing with household duties	91.30%
B5	Caring for other people or animals	72.10%
B6	Self-development activities	69.50%
B7	Moving from place to place	71.50%
B8	Daily leisure activities	73.30%
B9	Domestic weekend or holidays	67.40%
B10	Weekend or holiday abroad	64.20%

6. Discussion

In implementing hotel management processes, it is important to bear in mind that there is no evidence of a simple relationship between increased pro-environmental awareness and behavioural change (Wong et al., 2018). Using linear models can therefore lead to significant simplifications and false conclusions. Human environmental behaviours are also influenced by other factors such as attitudes and values, opportunities for environmental activities, motivational behaviours, perceptions of opinions on environmental behaviours. More detailed models and theories (e.g., the model of pro-ecological behaviours proposed by Fietkau and Kessel (1981), the theory of reasoned action, the transtheoretical model, the norm activation model, the self-determination theory) try to explain all these interrelations. It is also important to remember that organisational values such as trust, fairness and honesty are important factors in service quality assessment. The customer's perception of fairness increases trust and identification with the hotel, which, in turn, encourages the guest to engage in value co-creation (Roy et al., 2020). So, if hotels want their guests to protect the environment and refrain from destroying their resources, then hotels, as service providers, need to be fair towards their guests. This means, for example, not differentiating between customers in terms of their views and attitudes. It is also necessary to avoid situations that are a direct cause of quality gaps (e.g., gaps between what is offered and what others receive, between the image presented on the internet and the factual state, between what is promised and what is delivered). The fact that a hotel advertises itself, claims to follow green practices is insufficient even for the biggest advocates of the eco-economy. A green image can only be defended if guests receive the adequate quality of services and trust that the hotel is acting with integrity and its environmental efforts are genuine (Assaker et al., 2020). Yet another problem may be that people differ in their perception of the importance of financial resources. Some are obsessive about possessing them, while others are not necessarily so and adopt insurance attitudes (cf. Argyle, 1989).

It should be assumed that eco-innovations are fostered by environmental management systems, which results from their importance in building trust and orientation towards customers. While the low willingness to pay is a major obstacle to price reform, those with higher social trust are ready to pay more (cf. Blankenship et al., 2019). It can be assumed that one solution is the personification of services, which is possible especially when guests' stays are not short or frequent. In some areas, the personification of services is already being considered nowadays (cf. PR Newswire, 2021). There is also no doubt that the willingness to pay more should result from high service quality (cf. Dean et al., 2002). The problem, however, is the perception of service quality, which depends on customers' experience. Customers evaluate

service quality, taking into consideration its expected level and acceptable level. A service provided over a long period of time increases the level of desired quality (Hope and Mühlemann, 1997).

The conducted research was also verified by proposing solutions that could take the form of small open eco-innovations implementable in any hotel. Therefore, the surveyed guests who participated in the study were also asked to indicate the usefulness of such a tool from the perspective of those receiving hotel services. They are presented in this discussion as a set of recommendations, adaptable in contemporary hotel settings, as key open eco-innovations.

Nowadays, instead of developing and marketing new products, organisations are moving towards commercialisation. Therefore, open innovations are of great importance. The conceptual scope of open innovations comprises not only telecommunication and information technologies, but also organisational innovation, as well as internal and external knowledge management (Azhar Mohd Harif et al., 2022).

Historically, open innovations were studied from the perspective of manufacturing enterprises, while service businesses received much less attention, regardless of their dominant role in developed economies (Foroughi et al., 2015). At present, a toolbox approach to the concept of open innovation is being used as a strategic tool to improve the innovativeness of services and organisational effectiveness in the hospitality industry.

Many studies point to the benefits that hotels and the tourism sector can obtain. Their authors mention business performance (Foroughi et al., 2015; Azhar Mohd Harif et al., 2022), reduction of environmental impact and optimisation of natural resources (Sáez-Martínez et al., 2016), as well as better understanding of customer needs (Díaz and Duque, 2021). Innovations in open services have a positive effect on business performance, and this effect increases with the construct of competition intensity (Foroughi et al., 2015).

Hotels implement eco-innovations to reduce their environmental impact and optimise the use of natural resources (Sáez-Martínez et al., 2016). Open innovations allow the hotel industry to create platforms and channels for cooperation with customers, which results in a better understanding of their tastes and requirements (Díaz and Duque, 2021). The growing number of open innovation practices among hotels can improve business performance by increasing return on investment, return on assets, return on sales and return on equity (Azhar Mohd Harif et al., 2022).

The concept of open innovation (Chesbrough, 2003a, 2006; Yun, 2017; Yun et al., 2020) is used in many areas of everyday life. In tourism, for example, it is used to address problems with the availability of provided services (Ngeoywjit et al., 2022). Open innovations are needed for organisations within the hospitality industry to be able to learn faster and to change their business models, especially in the face of humanitarian threats (Szromek and Polok, 2022). Particularly in situations where the social good requires it (e.g., during climate disasters, epidemics), innovations should take on an open character because of the need to spread them (Szromek, 2021).

The second group of studies includes those that focus on the conditions for successful implementation (cf. Lalicic, 2018; Kazandzhieva, 2019; Zhang et al., 2022; de Andrés-Sánchez et al., 2022). The effectiveness of open innovations depends on how individual stakeholders communicate with each other (cf. Lalicic, 2018) and on the ability of tourism companies to establish effective networks with other stakeholders: suppliers, partners, customers, institutions, NGOs and others (Kazandzhieva, 2019). For open communication, organisational support and external interactions that allow the collection, utilisation and sharing of useful knowledge are very important (Zhang et al., 2022).

It is common knowledge that open innovations are not the only factor contributing to the achievement of competitive advantage. What is also necessary is a good strategy and, above all, adequate risk management (de Andrés-Sánchez et al., 2022). However, it is important to remember that open innovations improve corporate risk management and organisational strategy (Musiello-Neto et al., 2022).

Table 5

The verification of legitimacy of pro-environmental activities and measures undertaken in the form of open eco-innovations as perceived by hotel guests.

Source: the authors' own work

In your opinion, what is the importance of the following activities and measures for the state of the natural environment that can be undertaken in hotels? (C)	%	Environmental responsibility		Pro-ecological behaviours (PB) and innovative practices (IP)	
		Guests	Hotel		
C7	Installation of energy and water saving equipment	88.8%		x	IP
C19	Reducing food waste	87.8%	x		PB
C3	Generation of electricity from renewable energy sources	87.3%		x	IP
C15	Reducing the use of plastics	86.7%	x	x	PB
C4	Heating buildings with ecological fuels	86.2%		x	IP
C5	Use of energy-efficient light bulbs and appliances (e.g., household appliances, audio/video devices)	84.7%		x	IP
C9	Segregation of waste by employees and hotel guests	84.6%	x	x	PB + IP
C23	Compliance with environmental legislation	83.1%		x	IP
C6	Introducing various plants into the exterior and interior of the hotel	79.0%		x	IP
C10	Use of recycled (office or advertising) materials	78.8%		x	IP
C12	Use of biodegradable cleaning products and cosmetics	78.1%		x	IP
C8	Operating the hotel's own wastewater treatment plant	77.1%		x	IP
C17	Purchasing food from local producers	76.5%		x	IP
C2	Use of environmentally friendly building materials	76.3%		x	IP
C1	Seeking locations with low environmental impact	75.5%		x	IP
C21	Possessing and complying with the requirements of environmental management systems	75.4%		x	IP
C11	Changing towels and bed linen, cleaning the room only at guests' request	74.8%	x	x	IP + PB
C22	Implementation and compliance with the requirements of environmental policies or practices	74.8%	x	x	
C14	Pro-ecological training for employees	72.7%		x	
C16	Running a bike and scooter hire service	72.7%		x	
C13	Discounts and gifts for guests adopting pro-environmental behaviours	68.2%		x	
C20	Conducting social campaigns for the benefit of the natural environment	67.3%		x	
C18	A wide range of vegetarian and vegan dishes	64.8%		x	

Although in practice there is an effort directed at developing and implementing open innovations, these processes are not always successful (Chaudhary et al., 2022). Different stages of the innovation process are sometimes risky (Madanaguli et al., 2023). The best available knowledge or the best practical solutions are not always used. There is also a lack of adequate resources (Sáez-Martínez et al., 2016). Besides eco-innovations, the hospitality industry needs investments in digital infrastructure and smart technologies, especially during crisis periods (Han et al., 2021).

As part of the discussion of their research, the authors attempted to evaluate particular solutions in the form of open eco-innovations. The proposals presented in Table 5 should be considered in the category of business areas where innovative solutions should be sought. The result of verifying the validity of their use in the opinion of hotel guests is presented in Table 5. Some of these proposals will be difficult or impossible to implement in the case of existing hotels (e.g., choosing the right location). A significant part of eco innovations requires holistic solutions - both new infrastructure and appropriate behavior. But there are also proposals that are required - mandatory (e.g., compliance with environmental legislation) - which in the case of eco-innovations means specifying their own standardization requirements - and those that can be applied immediately without much effort (e.g., use of recycled (office or advertising) materials, use of biodegradable cleaning products and cosmetics).

We suggest that where an implemented environmental management system exists, these proposals should be included in the environmental improvement plans (objectives, tasks, responsible persons and implementation time, budget).

A preliminary classification of the most popular activities and measures that could be undertaken as part of hotels' operations and guests' staying in hotels shows a significant emphasis on the installation of energy and water saving equipment (88.8%) and the generation of electricity from renewable sources (87.3%), the use of energy saving

light bulbs and appliances (84.7%), as well as heating systems based on ecological fuels (86.2%) and compliance with environmental legislation (83.1%). However, promoting environmentally friendly behaviours among guests themselves is perceived as similarly useful. They point to the possibility of reducing food waste (87.8%) or limiting the use of plastic (86.7%). This shows that hotel guests do not look at environmental measures as the responsibility of hotels and their employees only but assume part of responsibility for this area of influence, treating it as a communal sphere (without attributing it to one group of beneficiaries). Another popular indication of a reciprocal nature is the segregation of waste by both employees and hotel guests (84.6%). Fig 7 presents the key environmental practices and eco-innovative behaviours indicated by the respondents.

If eco-innovations are to be advantageous for the environment on the one hand and bring about tangible benefits on the other, we propose systemic solutions that can be shared in the form of open innovations. Our assumption here is that the willingness to pay more for hotel services can be stimulated by guaranteeing a high quality of services and increasing guests' confidence in the environmental activities and measures undertaken by hotels.

Thus, on the basis of our research, we propose the following:

- to examine the needs and expectations of hotel guests and not only the level of their satisfaction with received services (needs and expectations become quality requirements),
- to examine relationship between the reasons for interest in eco innovations in hotels and their benefits,
- to enable hotel guests to participate in reviews of environmental management systems,
- to enable them to participate in the monitoring of all processes and in the evaluation of their results,
- to enable hotel guests to actively participate in internal and external audits,

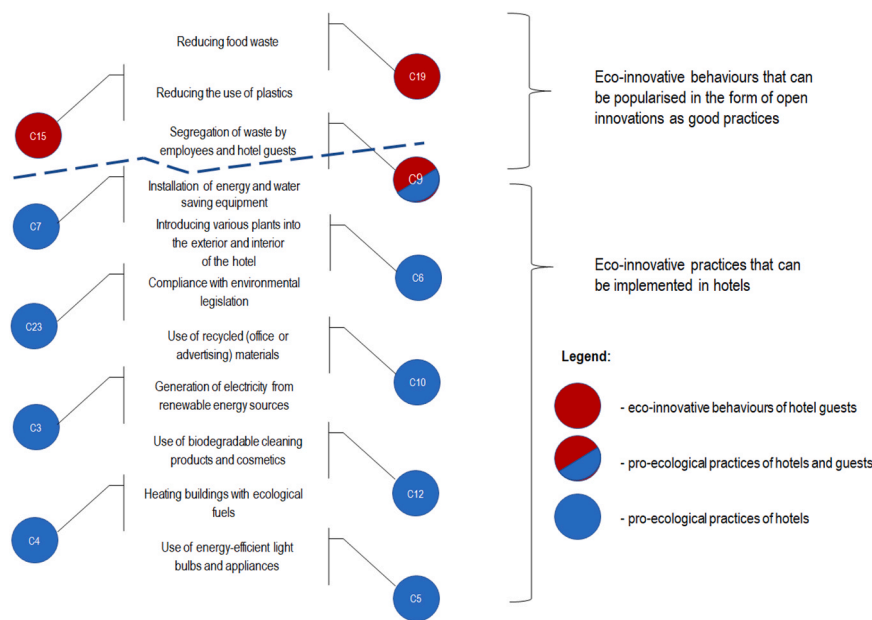


Fig. 7. The key eco-innovative practices and behaviours relating to hotels' responsibility for their environmental impact.

- to increase hotel guests' participation in the design of environmental programmes, plans and tasks on the basis of open innovations,
- to introduce benchmarks of open eco-innovations (so as to improve knowledge sharing and verification).

In our opinion results of this research can be applied in practice.

First of all, since co-responsibility for the environment is declared by guests, it is worth considering the possibility of involving hotel guests - on a voluntary basis in environmental reviews and system audits (this is how various cities act today). In this way, their knowledge and experience can be helpful in developing appropriate environmental goals and tasks.

Secondly, the research results indicate a relationship between awareness and pro-environmental behavior, and if so, it is worth educating guests. Here, however, conventional methods may turn out to be insufficient and it may be worth using other methods (e.g., competitions, games and activities).

Thirdly, it is difficult for guests to give up certain behaviors (e.g., using a shower instead of a bathtub). And that is why eco-innovations are needed - focused improvement of infrastructure (in this case, better results can be achieved without interfering with the needs of hotel guests).

7. Conclusion

Summarising the knowledge obtained in the field of eco-innovations applied in hotels and the willingness of guests to incur additional costs related to pro-environmental measures taken by hotels, it is worth noting that the surveyed hotel guests adopted an attitude of shared responsibility for the environment. They did not avoid extra charges related to it. This applies to both financial burdens and environmental restrictions. The willingness to accept financial burdens was declared by more than one third of the respondents, the majority of them accepted such extra costs at a relatively low level of 4–10%. What dominated among the non-financial burdens associated with restrictions and behavioural adjustments was the habits of turning off unnecessary lights and avoiding the wastage of food and beverages. They were declared by over 90% of the respondents. Slightly lower scores were obtained in the case of behaviours related to personal hygiene and cleanliness, for example taking a shower rather than a bath and keeping

visited places clean. It was much more difficult for the respondents to give up the use of a car during their stay and travel by public transport, or to try to influence other visitors. In view of the fact that the majority of the respondents declared their acceptance of additional costs and pro-ecological behaviours, it should be concluded that the obtained results confirm hypothesis H2. During their stay, hotel guests share with their hotels the responsibility for environmentally friendly activities and measures.

It was also observed that there was a close correspondence between the lack of willingness to incur additional charges and the low and very low rating of environmental awareness of hotel guests. Correlations between the willingness to incur additional expenses and characteristics such as gender, education and economic status turned out to be significant and positive (H1b, H1c). Furthermore, the reason for staying in a hotel and the age of hotel guests were found to have a significant influence on pro-ecological behaviours, with younger people declaring such behaviours more often (H1a). Guests staying in hotels as part of their holidays were less likely to adopt some environmentally favourable behaviours. Undoubtedly, however, each activity or measure may constitute an important element of a hotel's eco-innovativeness, which, when shared with other hotels as a good practice, takes on the characteristics of an open eco-innovation. Therefore, it is worth noting that the results concerning the analysis of the socio-economic characteristics and declared pro-ecological behaviours of hotel guests also allow for the confirmation of hypothesis H1.

Among the weaknesses and challenges of the conducted research, it is necessary to indicate the declarative nature of the opinions provided by the respondents and the over-representation of the group of young people in their sample. It is therefore necessary to accept that declarations of taking specific measures cannot be equated with actually taking them. As far as the aforementioned over-representation of the young is concerned, it should be emphasised that although people under 25 also visit hotels, their stays are often connected with travelling in groups. In such circumstances, the choice of a hotel is determined by another factor, i.e., ensuring accommodation for members of a particular group in one establishment. Contrary to appearances, this factor may turn out to be quite important, which may influence subsequent assessments. In the future, a targeted selection of a research sample should be taken into consideration. It could be stratified sampling focused on the structure of the recipients of hotel services.

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